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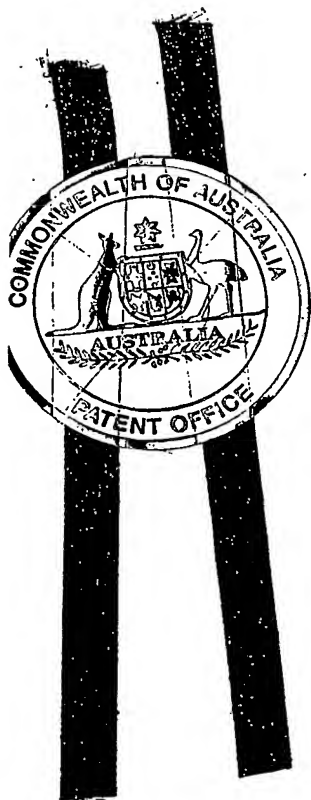
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I, JULIE BILLINGSLEY, TEAM LEADER EXAMINATION SUPPORT AND SALES hereby certify that annexed is a true copy of the Provisional specification in connection with Application No. 2002953575 for a patent by HELLA ASIA PACIFIC PTY LTD as filed on 24 December 2002.

WITNESS my hand this  
Twentieth day of January 2004

JULIE BILLINGSLEY  
TEAM LEADER EXAMINATION  
SUPPORT AND SALES



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AUSTRALIA  
Patents Act 1990

**PROVISIONAL SPECIFICATION**

**Applicant(s):**

HELLA ASIA PACIFIC PTY LTD  
A.C.N. 004 516 947

**Invention Title:**

A FILTER

The invention is described in the following statement:

A FILTER

This invention relates to a filter for use with ventilated electrical equipment.

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Ventilated electrical equipment, especially lighting, suffers from the entry of moisture, dirt and corrosive chemicals into what appear to be sealed area of the equipment. This entry causes deterioration and ultimate breakdown of the equipment.

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The root cause of the entry of potentially harmful fluids/contaminants is primarily the result of the expansion and contraction of air within the electrical equipment caused by changes in temperature.

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The process is typically illustrated with reference to figure 1 which is a standard light fitting. It is however understood the process is equally applicable to many other types of electrical equipment such as motors, transformers, junction boxes and cables.

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Figure 1 is a schematic illustration of a conventionally sealed lighting system in which enclosure E contains a light bulb L and a cover C closes off the enclosure via a peripheral gasket or seal S. The air immediately surrounding the lighting equipment is indicated as SA the ambient air is indicated as A.

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Four steps make up the process that can ultimately result in a failure of the light.

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Step 1 - At installation the light is connected and closed up, trapping air inside the enclosure. The air is now at ambient temperature and pressure.

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Step 2 - The lamp is energised and starts to

radiate 80% or more heat into the trapped air, heating the air quite effectively. The increased temperature increases the internal pressure.

5           Step 3 - The pressurised internal air now finds ways to escape into the ambient air, which is at a lower pressure and temperature than the air inside the light. This escape is notwithstanding the presence of seals. The escape of the pressurised internal air takes place until  
10 the internal pressure is equal to the ambient pressure.

          Step 4 - The lamp is then switched off, allowing the internal air to cool and the pressure decreases which reverses the process in step three and causes entry of air  
15 into the enclosure.

          This process is exasperated by some still further less obvious activity, such as the air in the immediate vicinity of the light is warmed by radiated heat from the  
20 light. This heating would initially lower the relative humidity of the air immediately surrounding the light but is quickly balanced by diffusion from the ambient air, effectively creating a pocket of warm air at the same relative humidity as the ambient air. This warm air  
25 enters the enclosure when the light is switched off. When the light reaches ambient temperature the excess moisture trapped inside cannot diffuse into the external air but condenses onto some surface like the lens of the light.

30           When the lamp is energised again and step 1 starts the heated air expands and leaves the light much faster than the condensate can evaporate. Thus most of the collected moisture remains inside the light. The internal pressure stabilises, the internal air warms up  
35 and the remaining condensate evaporates into it. When the lamp is later switched off, another load of slightly more humid air enters the light. This soon forms a heavy

deposit of condensate collecting on the inside of the enclosure. The entry of air also has the habit of drawing in fine dust and any other corrosive materials that might be present in the air. Electrical faults occur when the condensate or carbon deposits create alternative circuits. In acid or salt laced air the conductivity of the trapped condensate may be several orders higher than tap water, thus further contributing to breakdown of the electrical system.

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The cyclic system described above concentrates the contaminants in the condensate and while the lamp supplies heat that speeds up the corrosive action compared with the same material at lower concentration and temperatures. In the event that a light is covered in a layer of moisture from dew or rain, the normally insignificant contribution of capillary action is increased significantly by the suction of a cooling light.

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Although seals are very effective to stop particulate and liquids entering an enclosure, this effectiveness is particularly increased if they can be compressed into seats. This is not always possible particularly where the equipment has to be readily dismantled for service.

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It is these issues that have brought about the present invention.

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#### SUMMARY OF THE INVENTION

According to a first aspect of the present invention a filter defines an air passageway and three successive stages defined by a porous membrane, activated carbon and silica gel.

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According to a further aspect of the invention

there is provided:

A three stage breather filter for electrical equipment having

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a filter housing defining an airflow passageway

the passageway including three successive filter stages defined by

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a) a porous membrane

b) activated carbon, and

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c) silica gel.

Preferably the passageway defines an air inlet at one end and an outlet at the other, the outlet being arranged to be coupled to the electrical equipment.

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#### DESCRIPTION OF THE DRAWINGS

An embodiment of the present invention will now be described by the way of example and with reference to Figure 2 the accompanying drawings which is a schematic illustration of a light fitting incorporating a filter in accordance with an embodiment of the present invention.

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#### DESCRIPTION OF THE PREFERRED EMBODIMENT

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The preferred embodiment as illustrated in Figure 2 is a schematic illustration of a light fitting that comprises a rectangular enclosure 10 that contains a light bulb 11. The enclosure 10 is sealed by an external cover 12 via a peripheral seal or gasket 13. A filter 20 in the form of a cascade filter is adapted to be coupled to the enclosure. The cascade filter comprises a cylindrical

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housing 21 open at both ends 22 and 23 to define a fluid passageway. One end 23 is in fluid communication with the enclosure 10. The cylindrical housing 21 includes a block 25 of silica gel adjacent the end 23 that is attached to the housing 11. The block 25 of gel is positioned slightly spaced apart from a block 26 of activated carbon. A membrane barrier 27 is positioned on top of the activated carbon block 26 in close proximity to the outlet 22 of the housing 21. The filter 20 is designed so that air can flow in and out of the filter as described below.

The filter operates in the following manner. Initially the light goes through the three steps described in the introduction of the specification. Step 4 starts when the lamp 11 is switched off and the internal air starts to cool and the pressure decreases whereby drawing air into the enclosure 10 through the cascade filter 20. The air first passes through the micro-porous membrane 27 that is fabricated from PTFE or other such material. This membrane 27 filters out particulate matter to a predetermined size, typically to sub-micron level. The membrane also forms a vapour barrier that stops water entering. This can include pressurised water and detergents from high pressure cleaners.

The air then passes through the activated carbon block 26 that strips most corrosive chemicals and free radical oxidants through adsorption. After leaving the activated carbon block 26 the air passes through silica gel 25 that dehydrates the air further. The air then enters the enclosure 10 at ambient temperature and pressure containing no moisture or corrosive agents. When the light is switched on and starts to radiate 80% or more heat into the trapped air, the air heats up effectively increasing its temperature and pressure. The pressurised internal air now exits the filter 20 until the internal pressure is equal to the ambient pressure. When the lamp

is switched off the operation is repeated. In this manner the cyclic turning on and off of the lamp does not draw moisture or corrosive elements into the enclosure.

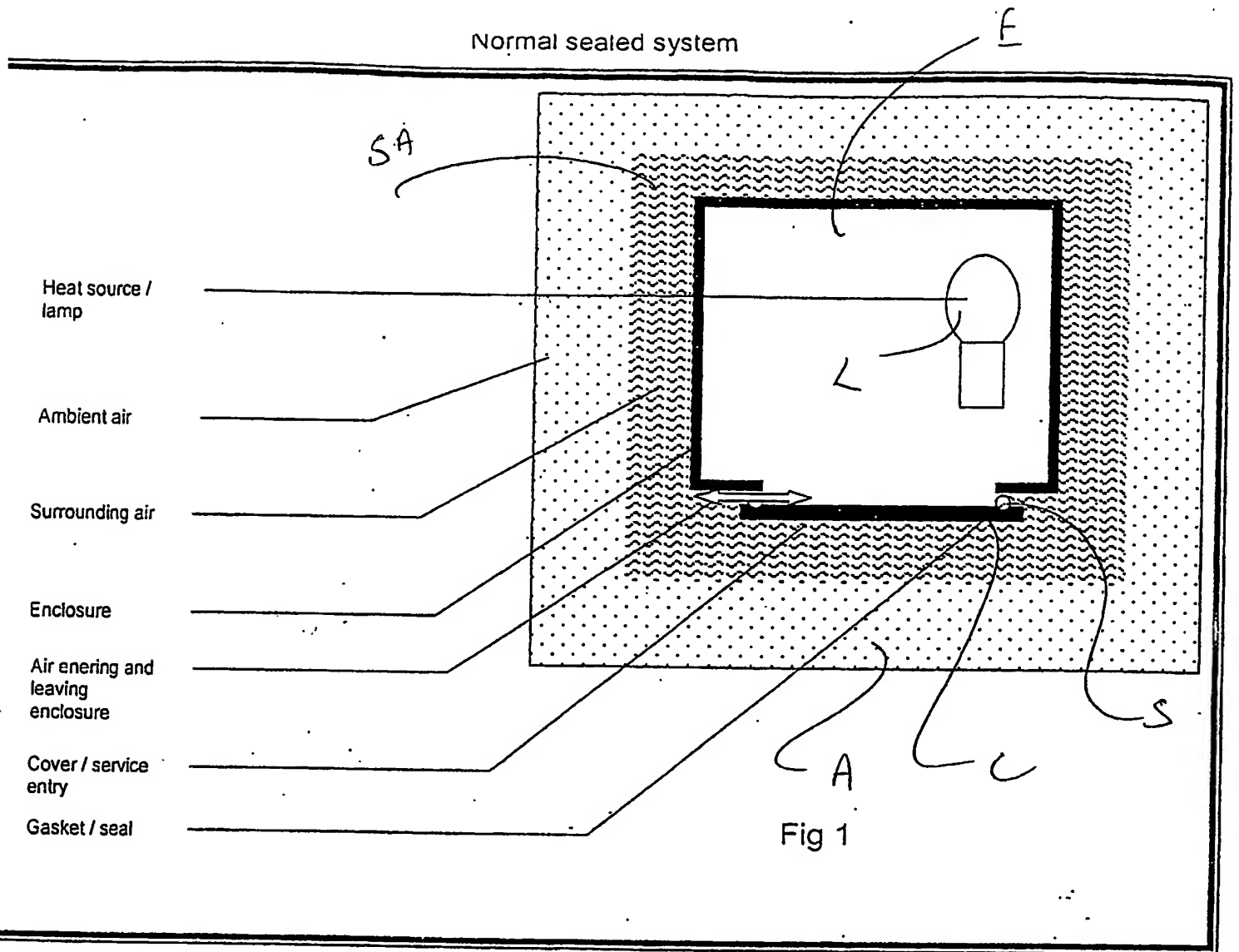
5           The filter 20 effectively cleans the air mechanically and chemically to a level that prevents deterioration of the optical surface through corrosion and contamination. This ensures that the light effectively  
10 retains the light output and distribution to which it was originally designed, whilst extending its operational life significantly. Because the exiting air is hot, it dries out the silica gel 25 on the way out removing the moisture to the atmosphere. Thus all the benefits of higher volumetric moisture capacity of warm air accrues to the  
15 recycling system. The PTFE membrane 27 is self cleaning because dirt does not stick to it.

          Whilst the drawing (Figure 2) is merely a schematic illustration of the introduction of the filter  
20 it will be understood that electrical equipment would be designed to incorporate the filter at the design phase of the product. The filter will be designed in the position whereby the majority of the air flows through the low resistance filter with only a small proportion passing  
25 through the high resistant paths that would be represented by seals and gaskets. This simple measure reduces the effect of seal imperfection and maintains the initial effectiveness over the life of the product. Because there is effectively no pressure differential across the seals,  
30 the stress is reduced eliminating air transportation and capillary action. Thus with correct implementation it is considered that the filter will extend the life of the product, the seals and the enclosure without additionally adding to the production costs. The use of a filter of  
35 the kind described above provides ventilation for enclosures that will solve the vast majority of corrosion and fouling problems that occur. This sort of equipment



is particularly useful where the equipment is continually used in dirty or corrosive environments like mines or petrochemical plants. It is further understood that the filter will be used with a whole variety of electrical  
5 equipment not just lighting systems.

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Cascade Filter system

